Installation of new machinery is another responsibility of industrial machinery repairers. As plants retool and invest in new equipment, they increasingly rely on these workers to properly situate and install the machinery. In many plants, this has traditionally been the job of millwrights. (See the statement on millwrights elsewhere in the *Handbook*.) As employers increasingly seek workers who have a variety of skills, industrial machinery repairers are taking on new responsibilities.

Working Conditions

Working conditions for repairers who work in manufacturing are similar to those of production workers. These workers are subject to common shop injuries such as cuts and bruises, and use protective equipment such as hard hats, protective glasses, and safety belts. Industrial machinery repairers may also face additional hazards because they often work on top of a ladder or underneath or above large machinery in cramped conditions.

Because factories and other facilities cannot afford breakdowns of industrial machinery, repairers may be called to the plant at night or on weekends for emergency repairs. Overtime is common among industrial machinery repairers—more than a third work over 40 hours a week.

Employment

Industrial machinery repairers held about 535,000 jobs in 1998. About 7 of every 10 worked in manufacturing industries, primarily food processing, textile mill products, chemicals, fabricated metal products, and primary metals. Others worked for government agencies, public utilities, mining companies, and other establishments in which industrial machinery is used.

Industrial machinery repairers work in a wide variety of plants and are employed in every part of the country. However, employment is concentrated in heavily industrialized areas.

Training, Other Qualifications, and Advancement

Many industrial machinery repairers learn their trade through a 4-year apprenticeship program combining classroom instruction with on-the-job-training. These programs are usually sponsored by a local trade union. Other workers start as helpers and pick up the skills of the trade informally and by taking courses offered by machinery manufacturers and community colleges.

Repairers learn from experienced repairers how to operate, disassemble, repair, and assemble machinery. Classroom instruction focuses on subjects such as shop mathematics, blueprint reading, welding, electronics, and computer training.

Most employers prefer to hire those who have completed high school. High school courses in mechanical drawing, mathematics, blueprint reading, physics, computers, and electronics are especially useful.

Mechanical aptitude and manual dexterity are important characteristics for workers in this trade. Good physical conditioning and agility are also necessary because repairers sometimes have to lift heavy objects or climb to reach equipment located high above the floor.

Opportunities for advancement are limited. Industrial machinery repairers advance either by working with more complicated equipment or by becoming supervisors. The most highly skilled repairers can be promoted to master mechanic or can become machinists or tool and die makers.

Job Outlook

Employment of industrial machinery repairers is projected to grow more slowly than the average for all occupations through 2008. Nevertheless, applicants with broad skills in machine repair should have favorable job prospects. As more firms introduce automated production equipment, industrial machinery mechanics will be needed to ensure these machines are properly maintained and consistently in operation. However, many new machines are capable of self-diagnosis, increasing their reliability and, thus, reducing the need for repairers. As a result, most job openings will stem from the need to replace repairers who transfer to other occupations or leave the labor force.

Unlike many other manufacturing occupations, industrial machinery repairers are not usually affected by seasonal changes in production. During slack periods, when some plant workers are laid off, repairers often are retained to do major overhaul jobs. Although these workers may face layoff or a reduced workweek when economic conditions are particularly severe, they usually are less affected than other workers because machines have to be maintained regardless of production level.

Earnings

Median hourly earnings of industrial machinery repairers were $15.31 in 1998. The middle 50 percent earned between $12.20 and $19.02. The lowest 10 percent earned less than $10.11 and the highest 10 percent earned more than $22.97.

Earnings vary by industry and geographic region. Median hourly earnings in the industries employing the largest numbers of industrial machinery repairers in 1997 are shown below:

Motor vehicles and equipment	$19.80
Metal forgings and stampings	17.70
Blast furnace and basic steel products	17.20
Electronic components and accessories	15.90
Machinery, equipment, and supplies	14.30
Miscellaneous plastics products, not elsewhere classified	14.10
Preserved fruits and vegetables	14.00
Hospitals	12.90
Meat products	12.00

Over 25 percent of industrial machinery mechanics are union members. Labor unions that represent industrial machinery repairers include the United Steelworkers of America; the United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Union of Electronic, Electrical, Salaried, Machine, and Furniture Workers.

Related Occupations

Other occupations that involve repairing machinery include aircraft mechanics and service technicians; elevator installers and repairers; machinists; millwrights; and automotive, motorcycle, diesel, farm equipment, general maintenance, mobile heavy equipment, and heating, air-conditioning, and refrigeration mechanics.

Sources of Additional Information

Information about employment and apprenticeship opportunities for industrial machinery repairers may be obtained from local offices of the State employment service or from:

☛ United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, DC 20001.

☛ The National Tooling and Machining Association, 9300 Livingston Rd., Fort Washington, MD 20744. Internet: **http://www.ntma.org**

☛ Precision Machined Products Association, 6700 West Snowville Rd., Brecksville, OH 44141. Internet: **http://www.pmpa.org**

Line Installers and Repairers

(O*NET 85702 and 85723)

Significant Points

- Line installer and repairer jobs require a high school diploma and, with experience, provide relatively high earnings.
- Employment is expected to grow due to the expansion of telecommunications networks.
- Line installers and repairers work outdoors under a variety of weather conditions.

Nature of the Work

Vast networks of wires and cables provide customers with electrical power and communications services. Networks of electrical power lines deliver electricity from generating plants to customers. Communications networks of telephone and cable television lines provide voice, video, and other communications services. These networks are constructed and maintained by line installers and repairers.

Line installers, or line erectors, install new lines by constructing utility poles, towers, and underground trenches to carry the wires and cables. Line erectors use a variety of construction equipment including digger derricks, trenchers, and cable plows. Digger derricks are trucks equipped with augers and cranes; the augers dig holes in the ground, and the cranes set utility poles in place. Trenchers and cable plows cut openings in the earth for laying underground cables.

When construction is complete, line installers string cable along the poles, towers, and trenches. For installations on poles and towers, the installers first climb or use truck-mounted buckets to reach the top of the structure. Next, they pull up cable by hand from large reels mounted on trucks. The line is then set in place and pulled so that it contains the correct amount of tension. Finally, the line installers attach the cable to the structure using handtools. When working with electrical powerlines, installers bolt or clamp insulators onto the poles before attaching the cable. Underground cable is laid directly in the trench, or strung through a conduit running through the trench.

Other installation duties include setting up service for customers and installing network equipment. To set up service, line installers string a piece of cable between the customers' premises and the lines running on poles, towers, or in trenches. They place wiring in houses and check that transmission signals are strong. Line installers may also install a variety of equipment. Workers on telephone and cable television lines install amplifiers and repeaters that maintain the strength of communications transmissions. Workers on electrical powerlines install transformers, circuit breakers, switches, and other equipment to control and direct the electrical current.

Line installers connect service to customers' homes.

In addition to installation, line installers and repairers are also responsible for maintenance of electrical, telephone, and cable television lines. The workers periodically travel in trucks, helicopters, and airplanes to visually inspect the wires and cables. Sensitive monitoring equipment can automatically detect malfunctions on the network, such as loss of current flow. When line repairers identify a problem, they travel to the location of the malfunction and repair or replace defective cables or equipment. Bad weather or natural disasters can cause extensive damage to networks. Line installers and repairers must respond quickly to these emergencies in order to restore critical utility and communications services.

Installation and repair work may require splicing, or joining together, separate pieces of cable. Each cable contains numerous individual wires; splicing the cables together requires that each wire in one piece of cable be joined to another wire in the matching piece. Line installers splice cables using small handtools, epoxy, or mechanical equipment. At each splice, they place insulation over the conductor and seal the splice with moisture proof covering.

Many communications networks now use fiber optic cables instead of conventional wire or metal cables. Fiber optic cables are made of thin strands of glass, which transmit pulses of light. These cables can carry more information at higher speeds than conventional cables. The higher transmission capacity of fiber optic cable has allowed communication networks to offer upgraded services, such as high speed Internet access.

Working Conditions

Line installers and repairers must climb and maintain their balance while working on poles and towers. They lift equipment and work in a variety of positions such as stooping or kneeling. Their work often requires that they drive utility vehicles, travel long distances, and work outdoors under a variety of weather conditions. Many line installers and repairers work a 40-hour week; however, emergencies may require overtime work. For example, when severe weather damages electrical and communications lines, line installers and repairers may work long and irregular hours to restore service.

Line installers and repairers encounter serious hazards on their jobs and must follow safety procedures to minimize the potential danger. They wear safety equipment when entering manholes and test for the presence of gas before going underground. Electric powerline workers have the most hazardous jobs. High voltage powerlines can cause electrocution and line installers and repairers must consequently install protective devices when working with live cables. Powerlines are typically higher than telephone and cable television lines, increasing the risk of severe injury due to falls. To prevent these injuries, line installers and repairers must use personal fall protection equipment when working on poles or towers.

Employment

Line installers and repairers held about 279,000 jobs in 1998. Approximately two-thirds were telephone and cable television line installers and repairers; the remainder were electrical powerline workers. Nearly all line installers and repairers worked for telephone, cable television, electric power, or construction companies.

Training, Other Qualifications, and Advancement

Line installers and repairers are trained on the job and most employers generally require only a high school diploma. However, technical knowledge of electricity and electronics obtained through vocational programs, community colleges, or experience in the Armed Forces is preferred. Prospective employees should possess a basic knowledge

of math and mechanical ability. Customer service and interpersonal skills are also important. Because the work entails climbing and other physical activity, applicants should have stamina, coordination, and must be unafraid of heights. The ability to distinguish colors is necessary because wires and cables may be coded by color.

Line installers and repairers working for electric power companies generally complete formal apprenticeship or employer training programs. These are sometimes administered jointly by the employer and the union representing the workers. The unions include the International Brotherhood of Electrical Workers, the Communications Workers of America, and the Utility Workers Union of America. Apprenticeship programs last several years and combine formal instruction with on-the-job training.

Line installers and repairers in telephone and cable television companies receive several years of on-the-job training. They may also attend training provided by equipment manufacturers, schools, or industry training organizations. The Society of Cable Television Engineers (SCTE) provides certification programs for line installers and repairers. Applicants for certification must be employed in the cable television industry, and attend training sessions at local SCTE chapters.

Entry-level line installers may be hired as groundmen, helpers, or tree trimmers, who clear branches from telephone and power lines. These workers may advance to positions stringing cable and performing service installations. With experience, they may advance to more sophisticated maintenance and repair positions responsible for increasingly larger portions of the network. Promotion to supervisory or training positions is also possible.

Job Outlook

Overall employment of line installers and repairers is expected to grow about as fast as the average for all occupations through 2008. Much of this increase will result from growth in the telecommunications industry. The introduction of new technologies, such as fiber optic cable, has increased the transmission capacity of telephone and cable television networks. This higher capacity has allowed the creation of new and extremely popular services, such as high-speed Internet access. At the same time, deregulation of the telecommunications industry has reduced barriers to competition. As a result, companies from a variety of industries are installing high capacity networks in order to compete for the increasing demand for telecommunications services. Mergers among highly competitive communications and electrical power companies may result in layoffs; however, these will be offset by growth due to the expansion of telecommunications networks. Besides employment growth, many job openings will result from the need to replace the large number of older workers reaching retirement age.

Employment of telephone and cable television line installers and repairers is expected to grow faster than average. Telephone and cable television companies will create new networks and expand existing ones to provide customers with high-speed access to data, video, and graphics. Line installers and repairers will be needed not only to construct and install networks, but also to maintain the ever-growing systems of wires and cables. Businesses will install extensive private networks as they increasingly use telecommunications lines for access to suppliers and customers. Residential customers will request additional lines to their houses in order to use telephone and Internet communications simultaneously.

The distribution of electrical power has not undergone the same transformation as has occurred in telecommunications, and the need for network expansion is not as great. As a result, the overall employment of electrical powerline installers and repairers should experience little or no growth. However, job openings will arise from the need to replace workers who retire or leave the occupation. Because electrical power companies have reduced hiring and training in recent years, opportunities should be best for workers who possess experience and training.

Earnings

Median hourly earnings for electrical powerline installers and repairers were $20.48 in 1998. The middle 50 percent earned between $16.30 and $23.90. The lowest 10 percent earned less than $11.54 and the highest 10 percent earned more than $33.32. Median hourly earnings in the industries employing the largest numbers of electrical powerline installers and repairers in 1997 are shown below.

Combination utility services	$23.60
Electrical services	20.00
Telephone communications	19.80
Electrical work	17.00
Heavy construction, except highway and street	14.10

Median hourly earnings for telephone and cable television line installers and repairers were $15.75 in 1998. The middle 50 percent earned between $10.97 and $21.42. The lowest 10 percent earned less than $8.85 and the highest 10 percent earned more than $24.54. Median hourly earnings in the industries employing the largest numbers of telephone and cable television line installers and repairers in 1997 are shown below.

Telephone communications	$19.90
Electrical work	12.30
Cable and other pay television services	11.60
Heavy construction, except highway and street	10.60

Most line installers and repairers belong to unions, principally the Communications Workers of America, the International Brotherhood of Electrical Workers, and the Utility Workers Union of America. For these workers, union contracts set wage rates, wage increases, and the time needed to advance from one step to the next.

Related Occupations

Related skilled craft positions include broadcast and sound technicians; electricians; and telecommunications equipment mechanics, installers, and repairers.

Sources of Additional Information

For more details about employment opportunities, contact the telephone, cable television, or electrical power company in your community. For general information on line installer and repairer jobs, write to:

☛ Communications Workers of America, 501 3rd St. NW., Washington, DC 20001.

☛ International Brotherhood of Electrical Workers, Utility Department, 1125 15th St. NW., Washington, DC 20005.

For general information on line installers and repairers and other power plant occupations, write to:

☛ Utility Workers Union of America, 815 16th St. NW., Washington, DC 20006.

For information on training and certification programs in the cable industry, contact:

☛ Society of Cable Telecommunications Engineers, Certification Department, 140 Philips Road, Exton, PA 19341.
Internet: **http://www.scte.org**

Maintenance Mechanics, General Utility

(O*NET 85119C and 85132)

Significant Points

- Most general maintenance mechanics are trained on the job; others learn by working as helpers to other repairers or construction workers such as carpenters, electricians, or machinery repairers.